Edexcel Chemistry GCSE

Topic 6 - Groups in the Periodic Table

Flashcards

How are elements arranged in the periodic table?

How are elements arranged in the periodic table?

Ordered by increasing atomic number.

Elements in the same group (column) have the same number of outer shell electrons.

Elements in the same period (row) have the same number of electron shells.

How many electrons are in the outer shell of a group 1 element?

How many electrons are in the outer shell of a group 1 element?

One

Why do elements in the same group have similar chemical properties?

Why do elements in the same group have similar chemical properties?

They have the same number of electrons in the outer shell.

What group of the periodic table are the alkali metals?

What group of the periodic table are the alkali metals?

Group 1

List two properties of alkali metals

List two properties of alkali metals

- Relatively low melting points
- Soft

Why are group 1 elements called the alkali metals?

Why are group 1 elements called the alkali metals?

They react with water to form alkaline solutions (pH greater than 7).

What are the products of the reaction between lithium and water?

What are the products of the reaction between lithium and water?

Lithium hydroxide and hydrogen.

Write a balanced symbol equation for the reaction of sodium with water

Write a balanced symbol equation for the reaction of sodium with water

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

Why should alkali metals be stored in oil?

Why should alkali metals be stored in oil?

To prevent them reacting with water vapour and oxygen in the air.

What would be observed when lithium reacts with water?

What would be observed when lithium reacts with water?

- Slowest reaction of the alkali metals.
- Bubbles of hydrogen are produced.
- Doesn't melt (highest melting point of alkali metals).

What would be observed when sodium reacts with water?

What would be observed when sodium reacts with water?

- Faster reaction than lithium.
- Floats on the surface of water (less dense than water).
- Bubbles of hydrogen are produced which cause the sodium to whizz around the surface of the water.
- Melts as enough energy is given out to meet sodium's melting point.

What would be observed when potassium reacts with water?

What would be observed when potassium reacts with water?

- More violent reaction than sodium.
- Bubbles of hydrogen are produced which cause the potassium to whizz around the surface of the water.
- Melts into a shiny ball.
- Burns with a lilac flame.

What is the order of reactivity of the first 3 alkali metals with water?

What is the order of reactivity of the first 3 alkali metals with water?

Lithium reacts least violent reaction, potassium reacts most violently:

Lithium < Sodium < Potassium

Using the reactions of the first 3 alkali metals with water, predict the reactivity trend down group 1

Using the reactions of the first 3 alkali metals with water, predict the reactivity trend down group 1

Reactivity increases down group 1.

Why does reactivity increase down group 1?

Why does reactivity increase down group 1?

The number of electron shells increases down the group so there is more electron shielding. As a result, there is weaker attraction between the positive nucleus and outer shell electron. This means it is easier to remove an outer shell electron to form a positive metal ion.

Which group 1 element would you expect to react most violently with water?

Which group 1 element would you expect to react most violently with water?

Reactivity increases down the group so francium will react most violently with water.

What group are the halogens in? Why?

What group are the halogens in? Why?

Group 7 because they have 7 outer shell electrons.

What is the colour and state of chlorine at room temperature?

What is the colour and state of chlorine at room temperature?

Pale green gas

What is the colour and state of bromine at room temperature?

What is the colour and state of bromine at room temperature?

Red-brown liquid

What is the colour and state of iodine at room temperature?

What is the colour and state of iodine at room temperature?

Black solid

Why are the halogens at different states at room temperature? What is the trend down the group?

Why are the halogens at different states at room temperature? What is the trend down the group?

At room temperature, chlorine is gaseous, bromine is liquid and iodine is solid because they have different melting and boiling points. As you go down the group, melting and boiling point increases.

What state would you expect the halogens fluorine and astatine to be at room temperature?

What state would you expect the halogens fluorine and astatine to be at room temperature?

Fluorine is above chlorine so should have a boiling point lower than chlorine. This means it would be a gas at room temperature.

Astatine is below iodine in group 7 so should have a higher melting point than iodine. Therefore you can predict that it would be a solid at room temperature.

Why does melting and boiling point increase down Group 7?

Why does melting and boiling point increase down Group 7?

The molecules get bigger down the group so there are more intermolecular forces to overcome during melting / boiling so more energy is required.

What is the chemical test for chlorine?

What is the chemical test for chlorine?

Damp litmus paper placed into a test tube of gas. If chlorine is present, the litmus paper will turn red then white due to the bleaching effect of chlorine.

Halogens are diatomic. What does this mean?

Halogens are diatomic. What does this mean?

They form molecules consisting of 2 atoms

E.g: Cl_2, Br_2 ...

What charge does a halide ion carry? Why?

What charge does a halide ion carry? Why?

-1

e.g. Cl^-, Br^-...

They gain one electron to have a stable electron configuration.

What is produced when a halogen reacts with a metal?

What is produced when a halogen reacts with a metal?

Metal halide salt

Write a balanced symbol equation for the reaction between bromine and sodium

Write a balanced symbol equation for the reaction between bromine and sodium

$$Br_2 + 2Na \rightarrow 2NaBr$$

Write a balanced symbol equation for the reaction between chlorine and calcium

Write a balanced symbol equation for the reaction between chlorine and calcium

$$Cl_2 + Ca \rightarrow CaCl_2$$

Predict the product of the reaction between magnesium and fluorine

Predict the product of the reaction between magnesium and fluorine

Magnesium fluoride (MgF_2)

Write a word equation for the reaction between iodine and potassium

Write a word equation for the reaction between iodine and potassium

Iodine + potassium → Potassium iodide.

Remember: the ion of a halogen ends with -ide.

Describe the trend in reactivity of the halogens. How does this affect the rate of reaction?

Describe the trend in reactivity of the halogens. How does this affect the rate of reaction?

Reactivity decreases down group 7.

Rate of reaction decreases down group 7.

What is formed when hydrogen reacts with a halogen?

What is formed when hydrogen reacts with a halogen?

Hydrogen halides

e.g. HCl, HBr...

Chlorine reacts with hydrogen in the presence of sunlight but bromine requires a flame. Why?

Chlorine reacts with hydrogen in the presence of sunlight but bromine requires a flame. Why?

Reactivity decreases down the group so bromine requires more energy for the reaction to occur.

What is formed when a hydrogen halide dissolves in water?

What is formed when a hydrogen halide dissolves in water?

An acidic solution. Hydrogen ions dissociate, making the solution acidic.

Write a balanced symbol equation for the reaction between hydrogen and chlorine

Write a balanced symbol equation for the reaction between hydrogen and chlorine

$$H_2 + Cl_2 \rightarrow 2HCl$$

Predict the product of the reaction between hydrogen and fluorine

Predict the product of the reaction between hydrogen and fluorine

Hydrogen fluoride (HF)

When does a halogen displacement reaction occur?

When does a halogen displacement reaction occur?

When a more reactive halogen displaces a less reactive halogen from an aqueous solution of its halide.

Why will halogen A only be displaced by halogen B if B is above A in group 7?

Why will halide ions A only be displaced by halogen B if B is above A in group 7?

The most reactive halogen (B) will displace the less reactive halogen (A) to become part of the ionic compound. Reactivity increases as you go up the group so B must be higher in group 7 to be more reactive than A.

Which halogens can chlorine displace from an aqueous ionic solution?

Which halogens can chlorine displace from an aqueous ionic solution?

Chlorine can displace any halogens below it in group 7. It will displace iodine and bromine.

Which halogens can't be displaced from an aqueous ionic solution by bromine?

Which halogens can't be displaced from an aqueous ionic solution by bromine?

Bromine can't displace any halogens above it in group 7. These are chlorine and fluorine.

Why can’t iodine displace chlorine or bromine from an aqueous ionic solution?

Why can iodine not displace chlorine or bromine from an aqueous ionic solution?

Because reactivity decreases down the group and iodine is below chlorine and bromine group 7. Displacement will only occur if iodine is more reactive than the halogen in the ionic compound.

Write the word equation for the reaction between chlorine and potassium bromide

Write the word equation for the reaction between chlorine and potassium bromide

Chlorine + potassium bromide → potassium chloride + bromine

Write the word equation for the reaction between bromine and calcium chloride

Write the word equation for the reaction between bromine and calcium chloride

No reaction will occur because bromine is less reactive than chlorine so chlorine won't be displaced.

Write the balanced symbol equation for the reaction that takes place between bromine and potassium iodide

Write the balanced symbol equation for the reaction that takes place between bromine and potassium iodide

$$Br_2 + 2KI \rightarrow I_2 + 2KBr$$

Which halogens would you expect astatine to be able to displace?

Which halogens would you expect astatine to be able to displace?

None of them. It is at the bottom of group 7 so has the lowest reactivity.

Why does reactivity decrease down group 7?

Why does reactivity decrease down group 7?

As you go down group 7, the outer shell is further from the nucleus and electron shielding increases. Attraction between the nucleus and outer electrons decreases so it is harder for the atom to gain an electron meaning reactivity decreases.

What colours are solutions of chlorine, bromine and iodine?

What colours are solutions of chlorine, bromine and iodine?

Chlorine water - colourless

Bromine water - orange

Iodine solution - brown

What would you observe when chlorine is added to potassium bromide?

What would you observe when chlorine is added to potassium bromide?

$Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$

Colour change from colourless (due to Cl_2) to orange (due to Br_2).

What is a redox reaction?

(higher only)

What is a redox reaction?

(higher only)

A reaction where oxidation and reduction take place at the same time.

Are halogen displacement reactions redox reactions? Explain your answer (higher only)

Are halogen displacement reactions redox reactions? Explain your answer (higher only)

Yes because the halide ion is oxidised (loses an electron) to form a halogen atom and the halogen is reduced (gains an electron) to form a halide ion.

Write the two half equations for the reaction between chlorine and potassium bromide, stating which is reduction and which is oxidation

(higher only)

Write the two half equations for the reaction between chlorine and potassium bromide, stating which is reduction and which is oxidation (higher only)

Overall equation: $Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$

Reduction: $Cl_2 + 2e^- \rightarrow 2Cl^-$

Oxidation: $2Br^- \rightarrow Br_2 + 2e^-$

Bromine reacts with potassium iodide. What is reduced and what is oxidised? (higher only)

Bromine reacts with potassium iodide. What is reduced and what is oxidised? (higher only)

Bromine is reduced to bromide ions.

Iodide ions are oxidised to iodine.

What name is used to describe the elements in group 0 of the periodic table?

What name is used to describe the elements in group 0 of the periodic table?

Noble gases

How many electrons do the noble gases have in their outer shell?

How many electrons do the noble gases have in their outer shell?

0

They have no incomplete shells of electrons.

What does chemically inert mean?

What does chemically inert mean?

Not chemically active.

Why are the noble gases chemically inert?

Why are the noble gases chemically inert?

They have full outer electron shells. This is a very stable electron configuration and means the elements are very unreactive.

What properties of helium makes it suitable for use in balloons?

What properties of helium makes it suitable for use in balloons?

It is less dense than air and does not burn.

Why is argon used to fill electric light bulbs?

Why is argon used to fill electric light bulbs?

It is very chemically inert so will not react when the light bulb gets hot. It is non-flammable.

Why is argon used for welding?

Why is argon used for welding?

It provides an inert welding atmosphere. Argon is more dense than air so keeps air away from the metal.

What is the trend in boiling points down group 0?

What is the trend in boiling points down group 0?

Boiling point increases down group 0 because the relative atomic mass increases so there are more intermolecular forces between atoms.

What is the trend in density down group 0?

What is the trend in density down group 0?

Density increases down the group. Helium is the least dense and radon is the most dense.